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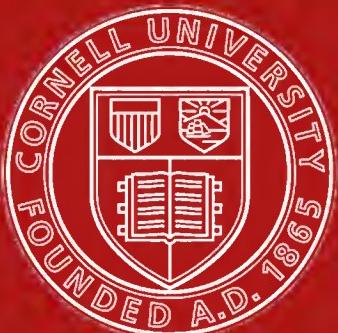


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A table of products :



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A
TABLE OF PRODUCTS,
BY THE
FACTORS 1 TO 9,
OF
ALL NUMBERS FROM
1 TO 100,000,
BY THE AID OF WHICH
MULTIPLICATION MAY BE PERFORMED BY INSPECTION.

WITH
An Introduction
EXPLANATORY OF ITS USE,

THE METHOD OF OBTAINING THE PRODUCTS OF NUMBERS EXCEEDING THE LIMITS OF THE TABLE.

BY
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LONDON:
CHARLES AND EDWIN LAYTON,
FLEET STREET.

1865.

P R E F A C E .

TABLES similar in their object to the one now introduced have been heretofore published. For much valuable information respecting them the reader is referred to the article "Table," in the *English Cyclopaedia* (col. 977, *et seq.*).

This Table is submitted to the notice of Actuaries and computers on the ground of its conciseness and portability, and the ease with which it may be used for calculations with very high numbers. The small space within which it is contained will, it is thought, render it especially convenient for a desk companion; and it will compare favourably, as regards the advantage it affords, with the bulky tomes noticed in the article above quoted. Those Tables, notwithstanding their dimensions, do not in certain cases furnish the means of obtaining more extensive results than can be effected by the aid of their present almost miniature competitor.

One of the Tables noticed in the *English Cyclopaedia*, entitled "Erleichterungs-Tafel," by Crelle, Berlin, 1836, consists of one thousand pages, each containing the same number of products as are contained in any one of the ten pages to which the present Table is confined; but that work, although one hundred times as large as this, must not, as already hinted, be estimated as presenting advantages proportionate to its vast difference of extent.

The Author considers it due to himself to make known, that at the time of designing and computing this Table he was altogether unacquainted with the "Erleichterungs-Tafel"; but he has since discovered that in some respects it bears a strong resemblance in point of arrangement to the present work.

Great care has been taken to secure accuracy in the typography. The computations, after being set up, have all been recomputed; and the revised proofs, after correction, have been again checked by recomputation. It is therefore believed that the Table is free from error, and that full confidence may be felt in its use.

INTRODUCTION.

[1] THE products contained in the following Table are so obviously related to each other by a common difference, that it is quite unnecessary to explain at length the method employed in their calculation. It will be seen that each quantity may be produced by merely adding to the one preceding it the factor at the head of the column. It will also be observed, that the quantities in each page may be combined in 100,000 different ways.

[2] The right-hand division of each page contains the products by the factors 1 to 9 of all numbers from 1 to 999; the left-hand division shows the products, by the same factors, of the thousands, from 1,000 to 99,000, including the carriage from the columns of the hundreds in the right-hand division of the same page.

[3] As an illustration of the mode of using the Table, let it be required to find the product of 75857×5 . Turning to page 9, in col. 5 opposite 857 we find 285 (the carriage of 4 resulting from the multiplication by 5 being provided for in the left-hand division of the page [2]; then entering col. 5 in the left-hand division of the same page, opposite 75, which represents 75,000, we find 379. These figures prefixed to those previously obtained give 379,285, the product sought.

[4] In general, it will be found most convenient to commence operating on the thousands, and afterwards to deal with the hundreds. Familiarity with the use of the Table, and practice, will however enable the computer to decide for himself as to the best mode of proceeding.

[5] In using the Table, whether for multiplication or division, it must always be entered at that page in which the three final figures of the multiplicand or divisor are situated.

[6] When the multiplicand consists of three figures only, the thousands, if any, resulting from its multiplication by any factor, must be sought in the left-hand division of the page even with 0 in the column headed with the same factor as that by which the products of hundreds is entered. An illustration of this rule is given in the first of the Examples which follow.

[7] In some parts of the Table, certain of the columns will be found marked with an asterisk (*), which is intended to indicate that the addition of unity must be made to the last figure in that column when the three final figures of the multiplicand are equal to or exceed those placed in brackets at the head and foot of the column. For instance, in finding the product of 15395×8 (page 4), in col. 8, opposite 15, left-hand division, we get 122; but the * shows that, when the three final figures are 375 and upwards, we must add 1 to the final figure of col. 8, left-hand division. We thus have for the first three figures of the product, 123. Then entering col. 8 of the right-hand division, even with 395 we find the remaining figures 160, and, placing them after the 123, obtain 123160, the correct product.

Some examples will now be adduced in illustration of the practical working of the Table.

Ex. I.—To find the product of 875×9 .

At page 9 [5], col. 9, right-hand division, even with 875 will be found 875, and turning to the left-hand division, col. 9, even with 0, we have the remaining figure of the product, viz. 7, which prefixed to those before extracted makes the complete product 7875 [6].

Ex. II.—The product of 75875×6 will be thus obtained:—
[3, 4, 5].

In col. 6, opposite 75, left-hand division, we find 455.

In col. 6, opposite 875, right-hand division . . . 250,
which figures, when placed in proper order, give the product 455,250.

The following example will exhibit the process when any one or more of the columns in the left-hand division are marked with an asterisk (*) [7].

Ex. III.—To multiply 82679 by 3.

In col. 3, opposite 82, is 247, to which add 1 as directed, and we have 248,

And in col. 3, opposite 649 . . . 037;
the correct result being 248037.

When the multiplier consists of several figures, it is obvious that we should arrange the partial products under each other in the same way as in ordinary multiplication. In using the present Table, however, it is deemed preferable, as before observed, to commence with the digit of the highest power, *i.e.*, from the left, as being illustrative of the method used in contracted multiplication of decimals, and so giving uniformity in practice, whether dealing with whole or fractional numbers.

Ex. IV.—The product of 97665×36925 is thus obtained:—
Entering the Table, page 10, we find,

In Left-hand Division.

97 × 3 . . 292
" " 6 . . 585
" " 9 . . . 878
" " 2 195
" " 5 488

In Right-hand Division.

665 × 3 . . 995
" " 6 . . . 990
" " 9 985
" " 2 330
" " 5 325

In practice, these quantities will of course be at once placed in their proper position, as follows:—

292995
585990
878985
195330
488325
<hr/>
3606280125

Ex. V.—To find the product of 25739 by 30778 [7].

In Left-hand Division.

$$\begin{array}{r} 77 \\ 180^* \\ 180^* \\ \hline 205 \end{array}$$

* See foot-note
in loco.

In Right-hand Division.

$$\begin{array}{r} 217 \\ 173 \\ 173 \\ \hline 912 \end{array}$$

which figures, placed in proper order, will be as follows:—

$$\begin{array}{r} 77217 \\ 180173 \\ 180173 \\ 205912 \\ \hline 792194942 \end{array}$$

The product of much higher numbers may be found in like manner where one of the factors does not exceed five figures. As an illustration, let it be required to find

Ex. VI.—The product of 9708738625 \times 92653.

$$\begin{array}{r} 92653 \times 9 \dots 833,877 \\ " \times 70 \dots 648,5710 \\ " \times 8 \dots 741,224 \\ " \times 7 \dots 648,571 \\ " \times 3 \dots 277,959 \\ " \times 8 \dots 741,224 \\ " \times 6 \dots 555,918 \\ " \times 2 \dots 185,306 \\ " \times 5 \dots 463,265 \\ \hline 899543759822125 \end{array}$$

The following example, in contracted multiplication of decimals, will sufficiently indicate the use of the Table when that process is employed:—

Ex. VII.—Required the value of 1.8775 \times 13.333, retaining only four places of decimals in the result.

$$\begin{array}{r} 18,775 \\ 56,325 \\ 56,33 \\ 56,3 \\ 56 \\ \hline 25,0327 \end{array}$$

In this example it is evident, by inspection, that the entire product should consist of 9 digits, 7 of which should be decimals. In extracting the tabular results, we may therefore, in the case before us, disregard all the figures which would stand beyond the sixth place from the left, and we can in like manner arrange other quantities to any required number of places. Care must, of course, be taken to make the usual addition of 1 to the last figure retained, where the first of the rejected figures is 5 or upwards.

The Table may also be employed for DIVISION. The following examples will, it is thought, be sufficient to illustrate the method of using it.

Ex. VIII.—To divide 3415625 by 27325, page 4 [5].

$$\begin{array}{r} 27325)3415625(125 \\ 27325 \dots \text{viz., } 27000 \times 1 \text{ and } 325 \times 1 \\ \hline 68312 \\ 54650 \dots \quad " \quad \times 2 \quad " \quad \times 2 \\ \hline 136625 \\ 136625 \dots \quad " \quad \times 5 \quad " \quad \times 5 \end{array}$$

Ex. IX.—Required the quotient of 899543759822125 \div 92653 (See *Ex. VI.* in Multiplication).

92653)899543759822125(9708738625

$$\begin{array}{r} 833877 \\ 656667 \\ 648571 \\ \hline 809659 \\ 741224 \\ \hline 684358 \\ 648571 \\ \hline 357872 \\ 277959 \\ \hline 799132 \\ 741224 \\ \hline 579081 \\ 555918 \\ \hline 231632 \\ 185306 \\ \hline 463265 \\ 463265 \end{array}$$

It is not considered necessary to explain this example beyond remarking that all the products are found as in Multiplication. The number of times the divisor is contained in the dividend and in each remainder (such number of times being the factor at the head of the column in which the nearest product appears) may be found by inspection in the page in which its three final figures are contained [5], in the line commencing with its first two figures.

The products of quantities, beyond the limits of the Table, may be found as in the following examples:—

Ex. X.—Multiply 1534927 \times 1234567.

From page 4, Left-hand Division.	From page 10, Left-hand Division.	From page 10, Right-hand Division.
15 \times 1 . 15	34 \times 1 . 34	927 \times 1 . 927
" \times 2 . 30	" \times 2 . 69	" \times 2 . 854
" \times 3 . 46	" \times 3 . 04	" \times 3 . 781
" \times 4 . . 61	" \times 4 . . 39	" \times 4 . . 708
" \times 5 . . 76	" \times 5 . . 74	" \times 5 . . 635
" \times 6 . . 92	" \times 6 . . 09	" \times 6 . . 562
" \times 7 . . 107	" \times 7 . . 44	" \times 7 . . 489

which, if at once placed in their proper order, would stand thus—

$$\begin{array}{r} 1534927 \\ 3069854 \\ 4604781 \\ 6139708 \\ 7674635 \\ 9209562 \\ \hline 10744489 \\ \hline 1894970221609 \end{array}$$

To work this example, it will be observed that it is requisite to refer to two pages of the Table instead of one, as in all the preceding illustrations; and it is to be particularly noted, that in all cases exceeding five figures in both multiplicand and multiplier we must look for the product of each group of two figures, to the left of the five final ones, in the left-hand division of the page which contains in its right-hand-division the three next following figures; and proceeding in this manner we may operate upon any number of digits. In general, it will occur in such high numbers that we must turn to as many pages as there are couples of digits to the left of the last five figures.

In dealing with numbers of very great magnitude, we may otherwise arrange the groups, say, in lustres, as in the next example.

Ex. XI.—Let it be required to find the square of 55555,55555,55555.

This quantity may be written as follows:—

$$\begin{array}{r} 55555,00000,00000 \\ + \quad 55555,00000 \\ + \quad \quad 55555 \end{array}$$

which is obviously identical. The sum of these groups may further be expressed as

$$(55555 \times 10^{10}) + (55555 \times 10^5) + 55555,$$

where the exponent of 10 in each case shows the number of ciphers which will occur in the result.

Calling the first group of the multiplicand m , the second n , and the third o ; and the first group of the multiplier p , the second q , and the third r , and multiplying them respectively into 10, raised to the several powers indicated by their position, we have

$$\begin{aligned} & (m \cdot 10^{10} + n \cdot 10^5 + o) \times (p \cdot 10^{10} + q \cdot 10^5 + r) \\ & = m \cdot p \cdot 10^{20} + n \cdot q \cdot 10^{10} + o \cdot r \\ & + m \cdot q \cdot 10^{15} + n \cdot r \cdot 10^5 \\ & + n \cdot p \cdot 10^{15} + o \cdot q \cdot 10^5 \\ & + m \cdot r \cdot 10^{10} \\ & + p \cdot o \cdot 10^{10} \end{aligned}$$

Then having found the square of 55555 to be 3086358025, and arranging the product of each group according to the number of ciphers to be appended, but omitting to set down the ciphers, the result will be as follows:—

$$\begin{aligned} mp \cdot 10^{20} + nq \cdot 10^{10} + or &= 3086358025/3086358025/3086358025 \\ + mq \cdot 10^{15} + nr \cdot 10^5 &= 3086358025/3086358025 \\ + np \cdot 10^{15} + oq \cdot 10^5 &= 3086358025/3086358025 \\ + mr \cdot 10^{10} &= 3086358025 \\ + po \cdot 10^{10} &= 3086358025 \\ \hline 308641975308641358024691358025 \end{aligned}$$

It will hence be obvious, generally, that the products of large numbers may be obtained—first, by finding separately the products of the several lustres or other groups into which the factors may be divided, and then arranging them as above pointed out; or, secondly,

by setting down the partial products of the groups as in the following example:—

Ex. XII.—Multiply 658349624743652
by 341659375256347.

19750	2	32917	0	21826	0
26333	36	3950	04	2619	12
65834		197502		1309	956
395004		263336		174608	
329170		460838		305564	
59250	6	48123	5		
197502		577482			
460838		288741			
329170		384988			
131668		673729			
28874	1	39286	8		
384988		130956			
96247		305564			
577482		218260			
481235		87304			
86622	3				
288741					
673729					
481235					
192494					
13095	6				
174608					
43652					
261912					
218260					
22493	13214	90166	62879	16609	59244

The totals of the several groups of partial products will be found to be as follows:—

$$\begin{aligned} 2249218610/3709548398/2459659244 \\ 6172069168/5423229709 \\ 3288278755/4092462304 \\ 9023348744 \\ 1491370580 \\ \hline 224931321490166628791660959244 \end{aligned}$$

Such cases being, however, rather curious than useful, it may be left to the reader to supply other illustrations should he wish to pursue the subject.

1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	50	100	150	200	250	300	350	400	450
1	2	3	4	5	6	7	8	9	100	150	200	250	300	350	400	450	500
2	4	6	8	10	12	14	16	18	51	102	153	204	255	306	357	408	459
3	6	9	12	15	18	21	24	27	52	104	156	208	260	312	364	416	468
4	8	12	16	20	24	28	32	36	54	108	162	216	270	324	378	432	486
5	10	15	20	25	30	35	40	45	55	110	165	220	275	330	385	440	495
6	12	18	24	30	36	42	48	54	56	112	168	228	280	336	392	448	504
7	14	21	28	35	42	49	56	63	67	114	171	228	285	342	399	456	513
8	16	24	32	40	48	56	64	72	78	116	174	232	290	348	406	464	522
9	18	27	36	45	54	63	72	81	59	118	177	236	295	354	413	472	531
10	20	30	40	50	60	70	80	90	60	120	180	240	300	360	420	480	540
11	22	33	44	55	66	77	88	99	61	122	183	243	305	366	427	488	549
12	24	36	48	60	72	84	96	108	62	124	186	248	310	372	434	496	558
13	26	39	52	65	78	91	104	117	63	126	189	252	315	378	441	504	567
14	28	42	56	70	84	98	112	126	64	128	192	256	320	384	448	512	576
15	30	45	60	75	90	105	120	135	65	130	195	260	325	390	455	520	585
16	32	48	64	80	96	112	128	144	66	132	198	264	330	396	462	528	594
17	34	51	68	85	102	119	136	153	67	134	201	268	335	402	469	536	603
18	36	54	72	90	108	126	144	162	68	136	204	272	340	408	476	544	612
19	38	57	76	95	114	133	152	171	69	138	207	276	345	414	483	552	621
20	40	60	80	100	120	140	160	180	70	140	210	280	350	420	490	560	630
21	42	63	84	105	126	147	168	189	71	142	213	284	355	426	497	568	639
22	44	66	88	110	132	154	176	198	72	144	216	288	360	432	504	576	648
23	46	69	92	115	138	161	184	207	73	146	219	292	365	438	511	584	657
24	48	72	96	120	144	168	192	216	74	148	222	296	370	444	518	592	666
25	50	75	100	125	150	175	200	225	75	150	225	300	375	450	525	600	675
26	52	78	104	130	156	182	208	234	76	152	228	304	380	456	532	608	684
27	54	81	108	135	162	189	216	243	77	154	231	308	385	462	539	616	693
28	56	84	112	140	168	196	224	252	78	156	234	312	390	468	546	624	702
29	58	87	116	145	174	203	232	261	79	158	237	316	395	474	553	632	711
30	60	90	120	150	180	210	240	270	80	160	240	320	400	480	560	640	720
31	62	93	124	155	186	217	248	279	81	162	243	324	405	486	567	648	729
32	64	96	128	160	192	224	256	288	82	164	246	328	409	492	574	653	738
33	66	99	132	165	198	231	264	297	83	166	249	332	415	498	581	664	747
34	68	102	136	170	204	238	272	306	84	168	252	336	420	504	588	672	756
35	70	105	140	175	210	245	280	315	85	170	255	340	425	510	595	680	765
36	72	108	144	180	216	252	288	324	86	172	258	344	430	516	602	688	774
37	74	111	148	185	222	259	296	333	87	174	261	348	435	522	609	696	783
38	76	114	152	190	228	266	304	342	88	176	264	352	440	528	616	704	792
39	78	117	156	195	234	273	312	351	89	178	267	356	445	534	623	712	801
40	80	120	160	200	240	280	320	360	90	180	270	360	450	540	630	720	810
41	82	123	164	205	246	287	328	369	91	182	273	364	455	546	637	728	819
42	84	126	168	210	252	294	336	378	92	184	276	368	456	548	644	736	828
43	86	129	172	215	258	301	344	387	93	186	279	372	465	558	651	744	837
44	88	132	176	220	264	308	352	396	94	188	282	376	470	564	658	752	846
45	90	135	180	225	270	315	360	405	95	190	285	380	475	570	665	760	855
46	92	138	184	230	276	322	368	414	96	192	288	384	480	576	672	768	864
47	94	141	188	235	282	329	376	423	97	194	291	388	485	582	679	776	873
48	96	144	192	240	288	336	384	432	98	196	294	392	490	588	686	784	882
49	98	147	196	245	294	343	392	441	99	198	297	396	495	594	693	792	891

1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
000	000	000	000	000	000	000	000	000	050	100	150	200	250	300	350	400	450
001	002	003	004	005	006	007	008	009	051	102	153	204	255	306	357	408	459
002	004	006	008	010	012	014	016	018	052	104	156	208	260	312	364	416	468
003	006	009	012	015	018	021	024	027	053	106	159	212	265	318	371	424	477
004	008	012	016	020	024	028	032	036	054	108	162	216	270	324	378	432	486
005	010	015	020	025	030	035	040	045	055	110	165	220	275	330	385	440	495
006	012	018	024	030	036	042	048	054	056	112	168	224	280	336	392	448	504
007	014	021	028	035	042	049	056	063	057	114	171	228	285	342	399	456	513
008	016	024	032	040	048	056	064	072	058	116	174	232	290	348	406	464	522
009	018	027	036	045	054	063	072	081	059	118	177	236	295	354	413	472	531
010	020	030	040	050	060	070	080	090	060	120	180	240	300	360	420	480	540
011	022	033	044	055	066	077	088	099	061	122	183	244	305	366	427	488	549
012	024	036	048	060	072	084	096	108	062	124	186	248	310	372	434	496	558
013	026	039	051	065	078	091	104	117	063	126	189	252	315	378	441	504	567
014	028	042	056	070	084	098	112	126	064	128	192	256	320	384	448	512	576
015	030	045	060	075	090	105	120	135	065	130	195	260	325	390	455	525	595
016	032	048	064	080	096	110	126	144	066	132	198	264	330	396	462	528	594
017	034	051	068	085	102	119	136	153	067	134	201	268	335	402	469	536	603
018	036	054	072	090	108	125	141	158	068	136	204	272	340	408	476	544	612
019	038	057	076	095	114	133	152	171	069	138	207	276	345	414	483	552	621
020	040	060	080	100	120	140	160	180	070	140	210	280	350	420	490	560	630
021	042	063	084	105	126	147	168	189	071	142	213	284	355	426	497	568	639
022	044	066	088	108	130	151	172	193	072	144							

1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
0	0	0	0	0	0	0	0	0	50	100	150	200	250	300	350	400	450	100	200	300	400	500	600	700	800	900	
1	2	3	4	5	6	7	8	9	102	153	204	255	306	357	408	459	101	202	303	404	505	606	707	808	909		
2	4	6	8	10	12	14	16	18	52	104	156	208	260	312	364	416	468	102	204	306	408	510	612	714	816	918	
3	6	9	12	15	18	21	24	27	53	106	159	212	265	318	371	424	477	103	206	309	412	515	618	721	824	927	
4	8	12	16	20	24	28	32	36	54	108	162	216	270	324	378	432	486	104	208	312	416	520	624	728	832	936	
5	10	15	20	25	30	35	40	45	55	110	165	220	275	330	385	440	495	105	210	315	420	525	630	735	840	945	
6	12	18	24	30	36	42	48	54	56	112	168	224	280	336	392	448	504	106	212	318	424	530	636	742	848	954	
7	14	21	28	35	42	49	56	63	57	114	171	228	285	342	399	456	513	107	214	321	428	535	642	749	856	963	
8	16	24	32	40	48	56	64	72	58	116	174	232	290	348	406	464	522	108	216	324	432	540	648	756	864	972	
9	18	27	36	45	54	63	72	81	59	118	177	236	295	354	413	472	531	109	218	327	436	545	654	763	872	981	
10	20	30	40	50	60	70	80	90	60	120	180	240	300	360	420	480	540	110	220	330	440	550	660	770	880	990	
11	22	33	44	55	66	77	88	99	61	122	183	244	305	366	427	488	549	111	222	333	444	555	666	777	888	999	
12	24	36	48	60	72	84	96	108	62	124	186	248	310	372	434	496	558	112	224	336	448	560	672	784	896	1008	
13	26	39	52	65	78	91	104	117	63	126	189	252	315	378	441	504	567	113	226	339	452	565	678	791	904	1017	
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* See "Introduction," [7].

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36	72	109	145	182	218	254	291	327	361	172	259	345	432	518	604	691	777
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40	80	121	161	202	242	282	323	363	401	180	271	361	452	542	632	723	813
41	82	124	165	207	243	289	331	372	411	182	274	365	457	548	639	731	822
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* See Introduction [7].

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